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Dr. Riemann's Zeros *In Search of the Riemann Zeros* On the Riemann Hypothesis *The Riemann Hypothesis* **Symmetry and the Zeros of Riemann's Zeta Function** Riemann Zeta The Riemann Hypothesis **The irrelevance of the location of Riemann's zeros to the disposition of the prime numbers** **Assigning of values of the prime number counting function to Bernhard Riemann's zeros. Concept of Dirichlet lines in the complex plane** *Lectures on the Riemann Zeta Function* Exploring the Riemann Zeta Function **The Statistics of the Zeros of the Riemann Zeta-function and Related Topics** *Stalking the Riemann Hypothesis* **The Riemann Zeta-function** *The Zeros of the Riemann Zeta Function* **The Riemann Zeta-Function** **The Theory of the Riemann Zeta-function** **Casimir Force, Casimir Operators and the Riemann Hypothesis** **Riemann's Zeta Function** *Prime Numbers and the Riemann Hypothesis* *Riemann Surfaces* *Bernhard Riemann 1826-1866* **Quantized Number Theory, Fractal Strings And The Riemann Hypothesis: From Spectral Operators To Phase Transitions And Universality** *Equivalents of the Riemann Hypothesis* **Prime Obsession** **Equivalents of the Riemann Hypothesis: Volume 1, Arithmetic Equivalents** *Conformal Mapping on Riemann Surfaces* *Simply Riemann* **The Zeros of the Riemann Zeta-function** **The Riemann Zeta-Function** **Linear Differential Equations and Group Theory from Riemann to Poincare** *Lectures on Riemann Surfaces* Computational Approach to Riemann Surfaces Riemann, Topology, and Physics *Introduction to Compact Riemann Surfaces and Dessins D'Enfants* Reassessing Riemann's Paper *The verification of a Riemann Hypothesis in the negative half of the complex plane* **The Riemann Boundary Problem on Riemann Surfaces** *The Zeros of the Riemann [zeta] Function* **Representing Measures and Associated Function Theory on Finite Bordered Riemann Surfaces**

Academic Paper from the year 2021 in the subject Mathematics - Analysis, grade: 2.00, , language: English, abstract: It is demonstrated in this work that we may construct an infinite number of strips in the complex plane having the same 'dimensions as the Critical Strip and which are devoid of Riemann zeros except on the line of symmetry. It is shown that the number of zeros on each line is infinite, indeed, there is a Riemann zero at infinity. It is posited that a form of the Riemann conjecture is verified in each strip. It is shown that each integer in the infinite set of the integers has an associated Riemann zero and that the imaginary parts of the complex number at which the zeros are located are proportional to the 'local' asymptote to the prime counting function. A connection between the prime counting function and the zeta function is established. A limited distribution of the Riemann zeros corresponding to their respective prime numbers is constructed and it is seen that, at least over this range, the two are correlated, albeit non-linearly. It is demonstrated that the imaginary part of the complex number locating a Riemann zero may, for any integer that can be articulated, be obtained by a few keystrokes of a hand calculator. The name of Bernard Riemann is well known to mathematicians and physicists around the world. His name is indelibly stamped on the literature of mathematics and physics. This remarkable work, rich in insight and scholarship, is addressed to mathematicians, physicists, and philosophers interested in mathematics. It seeks to draw those readers closer to the underlying ideas of Riemann’s work and to the development of them in their historical context. This illuminating English-language version of the original German edition will be an important contribution to the literature of the history of mathematics. The Riemann Hypothesis has become the Holy Grail of mathematics in the century and a half since 1859 when Bernhard Riemann, one of the extraordinary mathematical talents of the 19th century, originally posed the problem. While the problem is notoriously difficult, and complicated even to state carefully, it can be loosely formulated as "the number of integers with an even number of prime factors is the same as the number of integers with an odd number of prime factors." The Hypothesis makes a very precise connection between two seemingly unrelated mathematical objects, namely prime numbers and the zeros of analytic functions. If solved, it would give us profound insight into number theory and, in particular, the nature of prime numbers. This book is an introduction to the theory surrounding the Riemann Hypothesis. Part I serves as a compendium of known results and as a primer for the material presented in the 20 original papers contained in Part II. The original papers place the material into historical context and illustrate the motivations for research on and around the Riemann Hypothesis. Several of these papers focus on computation of the zeta function, while others give proofs of the Prime Number Theorem, since the Prime Number Theorem is so closely connected to the Riemann Hypothesis. The text is suitable for a graduate course or seminar or simply as a reference for anyone interested in this extraordinary conjecture. Superb high-level study of one of the most influential classics in mathematics examines landmark 1859 publication entitled “On the Number of Primes Less Than a Given Magnitude,” and traces developments in theory inspired by it. Topics include Riemann's main formula, the prime number theorem, the Riemann-Siegel formula, large-scale computations, Fourier analysis, and other related topics. English translation of Riemann's original document appears in the Appendix. Academic Paper from the year 2022 in the subject Mathematics - Analysis, grade: 2.2, , language: English, abstract: It is shown that there is a direct connection between the Riemann zeros, the counting numbers, and hence the prime numbers, but not in the so-called Critical Strip. A mathematical structure is developed in which the articulation of the numerical location of a Riemann zero in the sequence of zeros is sufficient to determine the counting number with which it is associated, its location, Im(s) on the line of symmetry and, the Gauss/Legendre prime number counting function. It is concluded that the disposition of the prime numbers within the system of counting numbers is solely an intrinsic characteristic of that system and is totally unrelated to the distribution of the Riemann zeros. In this book, the author pays tribute to Bernhard Riemann (1826-1866), a mathematician with revolutionary ideas, whose work on the theory of integration, the Fourier transform, the hypergeometric differential equation, etc. contributed immensely to mathematical physics. The text concentrates in particular on Riemann’s only work on prime numbers, including ideas – new at the time – such as analytical continuation into the complex plane and the product formula for entire functions. A detailed analysis of the zeros of the Riemann zeta-function is presented. The impact of Riemann’s ideas on regularizing infinite values in field theory is also emphasized. This revised and enhanced new edition contains three new chapters, two on the application of Riemann’s zeta-function regularization to obtain the partition function of a Bose (Fermi) oscillator and one on the zeta-function regularization in quantum electrodynamics. Appendix A2 has been re-written to make the calculations more transparent. A summary of Euler-Riemann formulae completes the book. This text covers exponential integrals and sums, 4th power moment, zero-free region, mean value estimates over short intervals, higher power moments, omega results, zeros on the critical line, zero-density estimates, and more. 1985 edition. Lucid, insightful exploration reviews complex analysis, introduces Riemann manifold, shows how to define real functions on manifolds, and more. Perfect for classroom use or independent study. 344 exercises. 1967 edition. Approach your problems from the right end It isn't that they can't see the solution. It is and begin with the answers. Then one day, that they can't see the problem. perhaps you will find the final question. G. K. Chesterton. The Scandal of Father 'The Hermit Clad in Crane Feathers' in R. Brown 'The point of a Pin'. van GuIik's The Chinese Maze Murders. Growing specialization and diversification have brought a host of monographs and textbooks on increasingly specialized topics. However, the "tree" of knowledge of mathematics and related fields does not grow only by putting forth new branches. It also happens, quite often in fact, that branches which were thought to be completely disparate are suddenly seen to be related. Further, the kind and level of sophistication of mathematics applied in various sciences has changed drastically in recent years: measure theory is used (non-trivially) in regional and theoretical economics; algebraic geometry interacts with physics; the Minkowsky lemma, coding theory and the structure of water meet one another in packing and covering theory; quantum fields, crystal defects and mathematical programming profit from homotopy theory; Lie algebras are relevant to filtering; and prediction and electrical engineering can use Stein spaces. And in addition to this there are such new emerging subdisciplines as "experimental mathematics", "CFD", "completely integrable systems", "chaos, synergetics and large-scale order", which are almost impossible to fit into the existing classification schemes. They draw upon widely different sections of mathematics. In 1859 Bernhard Riemann, a shy German mathematician, gave an answer to a problem that had long puzzled mathematicians. Although he couldn't provide a proof, Riemann declared that his solution was 'very probably' true. For the next one hundred and fifty years, the world's mathematicians have longed to confirm the Riemann hypothesis. So great is the interest in its solution that in 2001, an American foundation offered a million-dollar prize to the first person to demonstrate that the hypothesis is correct. In this book, Karl Sabbagh makes accessible even the airiest peaks of maths and paints vivid portraits of the people racing to solve the problem. Dr. Riemann's Zeros is a gripping exploration of the mystery at the heart of our counting system. Exploring the Riemann Zeta Function: 190 years from Riemann's Birth presents a collection of chapters contributed by eminent experts devoted to the Riemann Zeta Function, its generalizations, and their various applications to several scientific disciplines, including Analytic Number Theory, Harmonic Analysis, Complex Analysis, Probability Theory, and related subjects. The book focuses on both old and new results towards the solution of long-standing problems as well as it features some key historical remarks. The purpose of this volume is to present in a unified way broad and deep areas of research in a self-contained manner. It will be particularly useful for graduate courses and seminars as well as it will make an excellent reference tool for graduate students and researchers in Mathematics, Mathematical Physics, Engineering and Cryptography. This book is a study of how a particular vision of the unity of mathematics, often called geometric function theory, was created in the 19th century. The central focus is on the convergence of three mathematical topics: the hypergeometric and related linear differential equations, group theory, and on-Euclidean geometry. The text for this second edition has been greatly expanded and revised, and the existing appendices enriched. The exercises have been retained, making it possible to use the book as a companion to mathematics courses at the graduate level. “Jeremy Gray is one of the world’s leading historians of mathematics, and an accomplished author of popular science. In Simply Riemann he combines both talents to give us clear and accessible insights into the astonishing discoveries of Bernhard Riemann—a brilliant but enigmatic mathematician who laid the foundations for several major areas of today’s mathematics, and for Albert Einstein’s General Theory of Relativity. Readable, organized—and simple. Highly recommended." —Ian Stewart, Emeritus Professor of Mathematics at Warwick University and author of Significant Figures Born to a poor Lutheran pastor in what is today the Federal Republic of Germany, Bernhard Riemann (1826-1866) was a child math prodigy who began studying for a degree in theology before formally committing to mathematics in 1846, at the age of 20. Though he would live for only another 20 years (he died of pleurisy during a trip to Italy), his seminal work in a number of key areas—several of which now bear his name—had a decisive impact on the shape of mathematics in the succeeding century and a half. In Simply Riemann, author Jeremy Gray provides a comprehensive and intellectually stimulating introduction to Riemann's life and paradigm-defining work. Beginning with his early influences—in particular, his relationship with his renowned predecessor Carl Friedrich Gauss—Gray goes on to explore Riemann's specific contributions to geometry, functions of a complex variable, prime numbers, and functions of a real variable, which opened the way to discovering the limits of the calculus. He shows how without Riemannian geometry, cosmology after Einstein would be unthinkable, and he illuminates the famous Riemann hypothesis, which many regard as the most important unsolved problem in mathematics today. With admirable concision and clarity, Simply Riemann opens the door on one of the most profound and original thinkers of the 19th century—a man who pioneered the concept of a multidimensional reality and who always saw his work as another way to serve God. You don't know what it is to be me—the drug that I am, the drug I will be, the pure ecstasy. Here, let me cook up some of me! The world is not as it seems. But forget the world for now... The City stands alone as the only haven from government oppression, intentionally left so to serve mankind through its technological advances. The price this paradise pays for its creative freedom is deeper in cost than its denizens could ever fathom. The driver has been assigned a position at Civil Central Command, a relatively simple commission in a city with few regulations. However, this job requires much more work to investigate numerous unexplained deaths. People are dying—everywhere. With hardly any trail to go on, the driver is chasing a wraith. The City's light of advancement is darkened by death and destruction as two travelers set upon the City and square off in a showdown. The killer is restless... How many more must litter the floor? Formulated in 1859, the Riemann Hypothesis is the most celebrated and multifaceted open problem in mathematics. In essence, it states that the primes are distributed as harmoniously as possible--or, equivalently, that the Riemann zeros are located on a single vertical line, called the critical line. This text covers Riemann surface theory from elementary aspects to the fontiers of current research. Open and closed surfaces are treated with emphasis on the compact case, while basic tools are developed to describe the analytic, geometric, and algebraic properties of Riemann surfaces and the associated Abelian varities. Topics covered include existence of meromorphic functions, the Riemann-Roch theorem, Abel's theorem, the Jacobi inversion problem, Noether's theorem, and the Riemann vanishing theorem. A complete treatment of the uniformization of Riemann sufaces via Fuchsian groups, including branched coverings, is presented, as are alternate proofs for the most important results, showing the diversity of approaches to the subject. Of interest not only to pure mathematicians, but also to physicists interested in string theory and related topics. Manuscript minor thesis in mathematics. For 150 years the Riemann hypothesis has been the holy grail of mathematics. Now, at a moment when mathematicians are finally moving in on a proof, Dartmouth professor Dan Rockmore tells the riveting history of the hunt for a solution.In 1859 German professor Bernhard Riemann postulated a law capable of describing with an amazing degree of accuracy the occurrence of the prime numbers. Rockmore takes us all the way from Euclid to the mysteries of quantum chaos to show how the Riemann hypothesis lies at the very heart of some of the most cutting-edge research going on today in physics and mathematics. Comprehensive and coherent, this text covers exponential integrals and sums, 4th power moment, zero-free region, mean value estimates over short intervals, higher power moments, omega results, zeros on the critical line, zero-density estimates, distribution of primes, Dirichlet and various other divisor problems, and more. 1985 edition. This first volume of two presents classical and modern arithmetic equivalents to the Riemann hypothesis. Accompanying software is online. This volume contains the proceedings of the conference "Casimir Force, Casimir Operators and the Riemann Hypothesis - Mathematics for Innovation in Industry and Science" held in November 2009 in Fukuoka (Japan). The conference focused on the following topics: Casimir operators in harmonic analysis and representation theory Number theory, in particular zeta functions and cryptography Casimir force in physics and its relation with nano-science Mathematical biology Importance of mathematics for innovation in industry This book introduces prime numbers and explains the famous unsolved Riemann hypothesis. This thesis concerns statistical patterns among the zeros of the Riemann zeta function, and conditioned on the Riemann hypothesis proves several related original results. Among these: By extending a well known result of H. Montgomery, we show, at an only microscopically blurred resolution, that the distance between two randomly selected zeros of the zeta function tends to weakly repel away from the location of low-lying zeros of the zeta function. For random collections of consecutive zeros that are not so large as to see this resurgence effect, we support the view that they resemble the bulk eigenvalues of a random matrix by in particular proving an analogue of the strong Szego theorem. Concerning even smaller collections of zeros, we show that a statement that the zeros of the Riemann zeta function locally resemble the eigenvalues of a random matrix (the GUE Conjecture) is logically equivalent to a statement about the distribution of primes. On this basis, we make a conjecture for the covariance in short intervals of integers with fixed numbers of prime factors, weighted by the higher order von Mangoldt function. This is related to the so-called ratio conjecture. The covariance pattern is surprisingly simple to write down. We finally include a rigorous derivation that uniform variants of the Hardy-Littlewood conjectures agree with the GUE Conjecture. Even thus conditioned, the range of correlation test functions against which we may confirm the GUE pattern for zeta zeros remains limited. We consider in detail the case of two, three, and four point correlations, the two point case being due to Mongtomery. Academic Paper from the year 2022 in the subject Mathematics - Analysis, grade: 2.00, , language: English, abstract: Given their importance as the building blocks of all of the integers, the prime numbers, their number and dispositionwithin the integers have been studied for millennia. In 1859 Bernhard Riemann published a short paper (which only extended to six manuscript pages) concerned with an investigation of the number of prime numbers less than any given number. The outcome of the work revolutionised number theory and in the years following has resulted in almost what could be termed an industry in a particular aspect of his work, now called the Riemann Hypothesis. Riemann showed that all the zero values of the zeta function in the positive part of the complex plane should lie in a region between x = 0 and x = 1, and, in particular, conjectured that they all should lie on the line of symmetry x = 1?2. This conjecture, which is the basis of many other conjectures in Number Theory is considered by many mathematicians to be the currently greatest unsolved problem in Mathematics—so much so that the Clay Mathematical Institute of Boston, Mass. has offered one million dollars to anyone who can produce a solution. No attempt is made here to verify the hypothesis, for its validity is not required. A procedure is developed here, by means of which, the zeros of Riemann's zeta function in the so-called Critical Strip of the complex plane may be assigned values of the prime number counting function. The procedure is novel and uses the concept of a Dirichlet line in the complex plane and a quantity called a nearodd (both of which are defined in the text). The process may be rendered self-contained, in the sense that, when it is associated with Gram's series the only input required is the magnitude of the imaginary part of the function s = x + iy which will locate a Riemann zero on the Critical Line; vast numbers of zeros may be accessed in [2]. Further, it is shown that the Riemann conjecture is irrelevant in the assigning of any particular value of the prime number counting function to the corresponding Riemann zero. It is suggested, pace Wiles, who obtained a proof of Fermat's Last Theorem as a by-product of his verification of the Taniyama-Shimura conjecture, that, in the light of Godel's incompleteness theorems, Riemann's hypothesis may be undecidable. The Riemann zeta-function embodies both additive and multiplicative structures in a single function, making it our most important tool in the study of prime numbers. This volume studies all aspects of the theory, starting from first principles and probing the function's own challenging theory, with the famous and still unsolved "Riemann hypothesis" at its heart. The second edition has been revised to include descriptions of work done in the last forty years and is updated with many additional references; it will provide stimulating reading for postgraduates and workers in analytic number theory and classical analysis. Akademische Arbeit aus dem Fachbereich Mathematik - Analysis, Note: 2.00, , Sprache: Deutsch, Abstract: In this paper, a new zeta function is derived. The function is a novel form of a Riemann zeta function. Whilst all the exponents of the terms in the denominators in the series are complex numbers, the function can be shown to be real, zero or complex at any locations of interest in the complex plane. In particular, if regions having the dimensions of Riemann's Critical Strip are formed, where the line of symmetry passes through a trivial zero of Riemann's zeta function, it is shown that zeros values of this new function will only be found along these lines of symmetry, and, indeed, nowhere else in the negative half of the complex plane. It is then considered that this constitutes verification of a Riemann Hypothesis for this function in these regions. The Riemann hypothesis (RH) is perhaps the most important outstanding problem in mathematics. This two-volume text presents the main known equivalents to RH using analytic and computational methods. The book is gentle on the reader with definitions repeated, proofs split into logical sections, and graphical descriptions of the relations between different results. It also includes extensive tables, supplementary computational tools, and open problems suitable for research. Accompanying software is free to download. These books will interest mathematicians who wish to update their knowledge, graduate and senior undergraduate students seeking accessible research problems in number theory, and others who want to explore and extend results computationally. Each volume can be read independently. Volume 1 presents classical and modern arithmetic equivalents to RH, with some analytic methods. Volume 2 covers equivalences with a strong analytic orientation, supported by an extensive set of appendices containing fully developed proofs. An elementary account of the theory of compact Riemann surfaces and an introduction to the Belyi-Grothendieck theory of dessins d'enfants. Studying the relationship between the geometry, arithmetic and spectra of fractals has been a subject of significant interest in contemporary mathematics. This book contributes to the literature on the subject in several different and new ways. In particular, the authors provide a rigorous and detailed study of the spectral operator, a map that sends the geometry of fractal strings onto their spectrum. To that effect, they use and develop methods from fractal geometry, functional analysis, complex analysis, operator theory, partial differential equations, analytic number theory and mathematical physics.Originally, M L Lapidus and M van Frankenhuijsen 'heuristically' introduced the spectral operator in their development of the theory of fractal strings and their complex dimensions, specifically in their reinterpretation of the earlier work of M L Lapidus and H Maier on inverse spectral problems for fractal strings and the Riemann hypothesis.One of the main themes of the book is to provide a rigorous framework within which the corresponding question 'Can one hear the shape of a fractal string?' or, equivalently, 'Can one obtain information about the geometry of a fractal string, given its spectrum?' can be further reformulated in terms of the invertibility or the quasi-invertibility of the spectral operator.The infinitesimal shift of the real line is first precisely defined as a differentiation operator on a family of suitably weighted Hilbert spaces of functions on the real line and indexed by a dimensional parameter c. Then, the spectral operator is defined via the functional calculus as a function of the infinitesimal shift. In this manner, it is viewed as a natural 'quantum' analog of the Riemann zeta function. More precisely, within this framework, the spectral operator is defined as the composite map of the Riemann zeta function with the infinitesimal shift, viewed as an unbounded normal operator acting on the above Hilbert space.It is shown that the quasi-invertibility of the spectral operator is intimately connected to the existence of critical zeros of the Riemann zeta function, leading to a new spectral and operator-theoretic reformulation of the Riemann hypothesis. Accordingly, the spectral operator is quasi-invertible for all values of the dimensional parameter c in the critical interval (0,1) (other than in the midfractal case when c =1/2) if and only if the Riemann hypothesis (RH) is true. A related, but seemingly quite different, reformulation of RH, due to the second author and referred to as an 'asymmetric criterion for RH', is also discussed in some detail: namely, the spectral operator is invertible for all values of c in the left-critical interval (0,1/2) if and only if RH is true.These spectral reformulations of RH also led to the discovery of several 'mathematical phase transitions' in this context, for the shape of the spectrum, the invertibility, the boundedness or the unboundedness of the spectral operator, and occurring either in the midfractal case or in the most fractal case when the underlying fractal dimension is equal to ½ or 1, respectively. In particular, the midfractal dimension c=1/2 is playing the role of a critical parameter in quantum statistical physics and the theory of phase transitions and critical phenomena.Furthermore, the authors provide a 'quantum analog' of

Voronin's classical theorem about the universality of the Riemann zeta function. Moreover, they obtain and study quantized counterparts of the Dirichlet series and of the Euler product for the Riemann zeta function, which are shown to converge (in a suitable sense) even inside the critical strip.For pedagogical reasons, most of the book is devoted to the study of the quantized Riemann zeta function. However, the results obtained in this monograph are expected to lead to a quantization of most classic arithmetic zeta functions, hence, further 'naturally quantizing' various aspects of analytic number theory and arithmetic geometry.The book should be accessible to experts and non-experts alike, including mathematics and physics graduate students and postdoctoral researchers, interested in fractal geometry, number theory, operator theory and functional analysis, differential equations, complex analysis, spectral theory, as well as mathematical and theoretical physics. Whenever necessary, suitable background about the different subjects involved is provided and the new work is placed in its proper historical context. Several appendices supplementing the main text are also included. An engaging, informative, and wryly humorous exploration of one of the great conundrums of all time In 1859 Bernhard Riemann, a shy German mathematician, wrote an eight-page article giving an answer to a problem that had long puzzled mathematicians. But he didn’t provide a proof. In fact, he said he couldn’t prove it but he thought that his answer was “very probably” true. From the publication of that paper to the present day, the world’s mathematicians have been fascinated, infuriated, and obsessed with proving the Riemann Hypothesis, and so great is the interest in its solution that in 2001 an American foundation put up prize money of $1 million for the first person to demonstrate that the hypothesis is correct. The hypothesis refers to prime numbers, which are in some sense the atoms from which all other numbers are constructed, and seeks to explain where every single prime to infinity will occur. Riemann’s idea—if true—would illuminate how these numbers are distributed, and if false will throw pure mathematics into confusion. Karl Sabbagh meets some of the world’s mathematicians who spend their lives thinking about the Riemann Hypothesis, focusing attention in particular on “Riemann’s zeros,” a series of points that are believed to lie in a straight line, though no one can prove it. Accessible and vivid, The Riemann Hypothesis is a brilliant explanation of numbers and a profound meditation on the ultimate meaning of mathematics. The significantly expanded second edition of this book combines a fascinating account of the life and work of Bernhard Riemann with a lucid discussion of current interaction between topology and physics. The author, a distinguished mathematical physicist, takes into account his own research at the Riemann archives of Göttingen University and developments over the last decade that connect Riemann with numerous significant ideas and methods reflected throughout contemporary mathematics and physics. Special attention is paid in part one to results on the Riemann-Hilbert problem and, in part two, to discoveries in field theory and condensed matter. In August 1859 Bernhard Riemann, a little-known 32-year old mathematician, presented a paper to the Berlin Academy titled: "On the Number of Prime Numbers Less Than a Given Quantity." In the middle of that paper, Riemann made an incidental remark â€" a guess, a hypothesis. What he tossed out to the assembled mathematicians that day has proven to be almost cruelly compelling to countless scholars in the ensuing years. Today, after 150 years of careful research and exhaustive study, the question remains. Is the hypothesis true or false? Riemann's basic inquiry, the primary topic of his paper, concerned a straightforward but nevertheless important matter of arithmetic â€" defining a precise formula to track and identify the occurrence of prime numbers. But it is that incidental remark â€" the Riemann Hypothesis â€" that is the truly astonishing legacy of his 1859 paper. Because Riemann was able to see beyond the pattern of the primes to discern traces of something mysterious and mathematically elegant shrouded in the shadows â€" subtle variations in the distribution of those prime numbers. Brilliant for its clarity, astounding for its potential consequences, the Hypothesis took on enormous importance in mathematics. Indeed, the successful solution to this puzzle would herald a revolution in prime number theory. Proving or disproving it became the greatest challenge of the age. It has become clear that the Riemann Hypothesis, whose resolution seems to hang tantalizingly just beyond our grasp, holds the key to a variety of scientific and mathematical investigations. The making and breaking of modern codes, which depend on the properties of the prime numbers, have roots in the Hypothesis. In a series of extraordinary developments during the 1970s, it emerged that even the physics of the atomic nucleus is connected in ways not yet fully understood to this strange conundrum. Hunting down the solution to the Riemann Hypothesis has become an obsession for many â€" the veritable "great white whale" of mathematical research. Yet despite determined efforts by generations of mathematicians, the Riemann Hypothesis defies resolution. Alternating passages of extraordinarily lucid mathematical exposition with chapters of elegantly composed biography and history, Prime Obsession is a fascinating and fluent account of an epic mathematical mystery that continues to challenge and excite the world. Posited a century and a half ago, the Riemann Hypothesis is an intellectual feast for the cognoscenti and the curious alike. Not just a story of numbers and calculations, Prime Obsession is the engrossing tale of a relentless hunt for an elusive proof â€" and those who have been consumed by it. The aim of the series is to present new and important developments in pure and applied mathematics. Well established in the community over two decades, it offers a large library of mathematics including several important classics. The volumes supply thorough and detailed expositions of the methods and ideas essential to the topics in question. In addition, they convey their relationships to other parts of mathematics. The series is addressed to advanced readers wishing to thoroughly study the topic. The famous "nontrivial zeros" are a set of complex numbers that produce zero when given to Riemann's zeta function. This set of numbers influences the distribution of the prime numbers. The nontrivial zeros therefore lie at the very heart of mathematics, since every integer greater than 1 is a unique product of primes. Riemann's hypothesis is that the real part of each nontrivial zero is a half. The author, Anthony Lander, is a paediatric surgeon and not a mathematician. However, Anthony has had a longstanding interest in symmetry and symmetry breaking in biological systems. He came across Riemann's hypothesis in 2012 and believes that a symmetry evident in Euler's zeta underlies the truth of Riemann's hypothesis and why the zeros repel. This volume offers a well-structured overview of existent computational approaches to Riemann surfaces and those currently in development. The authors of the contributions represent the groups providing publically available numerical codes in this field. Thus this volume illustrates which software tools are available and how they can be used in practice. In addition examples for solutions to partial differential equations and in surface theory are presented. The intended audience of this book is twofold. It can be used as a textbook for a graduate course in numerics of Riemann surfaces, in which case the standard undergraduate background, i.e., calculus and linear algebra, is required. In particular, no knowledge of the theory of Riemann surfaces is expected; the necessary background in this theory is contained in the Introduction chapter. At the same time, this book is also intended for specialists in geometry and mathematical physics applying the theory of Riemann surfaces in their research. It is the first book on numerics of Riemann surfaces that reflects the progress made in this field during the last decade, and it contains original results. There are a growing number of applications that involve the evaluation of concrete characteristics of models analytically described in terms of Riemann surfaces. Many problem settings and computations in this volume are motivated by such concrete applications in geometry and mathematical physics. The Riemann zeta function was introduced by L. Euler (1737) in connection with questions about the distribution of prime numbers. Later, B. Riemann (1859) derived deeper results about the prime numbers by considering the zeta function in the complex variable. The famous Riemann Hypothesis, asserting that all of the nontrivial zeros of zeta are on a critical line in the complex plane, is one of the most important unsolved problems in modern mathematics. The present book consists of two parts. The first part covers classical material about the zeros of the Riemann zeta function with applications to the distribution of prime numbers, including those made by Riemann himself, F. Carlson, and Hardy-Littlewood. The second part gives a complete presentation of Levinson's method for zeros on the critical line, which allows one to prove, in particular, that more than one-third of non-trivial zeros of zeta are on the critical line. This approach and some results concerning integrals of Dirichlet polynomials are new. There are also technical lemmas which can be useful in a broader context.

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